

REMARKS

The Present Invention

The present invention relates to a polybenzazole article that comprises a polybenzazole and a light-resisting agent.

The Pending Claims

Claims 1-3 and 6 are currently pending. Reconsideration of the pending claims is respectfully requested.

Summary of the Office Action

The Examiner rejects claims 1-3 and 6 under 35 U.S.C. § 103(a) as obvious in view of So et al. (U.S. Patent 5,552,221).

Discussion of the Obviousness Rejection

According to the Examiner, So et al. discloses a polybenzazole article comprising polybenzazole and a naphthol dye. The Examiner concedes that So et al. does not disclose the specific light-resisting agents recited in the pending claims. However, the Examiner alleges that one of ordinary skill in the art would have been motivated to use the claimed light-resisting agents with a reasonable expectation of success since So et al. used naphthol that absorbs light with a wavelength of 300-600 nm.

The Examiner claims that the previously submitted Rule 132 declaration was not persuasive since no comparative example with naphthol was provided. Moreover, the Examiner states that "Applicant's arguments are based on the structures of the light resisting agents, whereas the Examiner's arguments are based on the functionality of said light-resisting agents, as in the claims (the claims disclose the functionality of said light resisting agent)" (see Office Action, page 3, 2nd full paragraph). Applicants point out that the pending claims recite *both* functional (allows for a regular reflectance of the article of not more than 30% in not less than 30% of the wavelength region of from 450 nm to 700 nm) *and* structural information (e.g., aniline, *o*-phenylenediamine) for the light-resisting agent. Therefore, it is quite reasonable for applicants to have argued that So et al. does not teach or suggest the structures of the claimed light-resisting articles. In particular, So et al. discloses the use of naphthol, which has a structure that is completely different than any of the light resisting agents recited in the pending claims. Moreover, not only are the structures of the claimed light-resisting agents not obvious in view of So et al., the inventive polybenzazole article,

when used with one or more of the claimed light-resisting agents, provides surprising and unexpected results.

As shown in the accompanying Declaration under 37 C.F.R. § 1.132, the polybenzazole article comprising a specific light-resisting agent of the present invention is markedly superior in light resistance as compared to the polybenzazole article containing a dye (including naphthol) as described in So et al. More specifically, the polybenzazole articles (Samples 6 and 7) containing *o*-aminophenol/*p*-phenylenediamine (1:1) or *m*-phenylenediamine/*p*-phenylenediamine (1:1) as light-resisting agents showed a strength retention of 34% or 55%, respectively, after 24 hours of xenon light exposure. As is clear from the comparison of the strength retention (34% and 55%) of the inventive polybenzazole articles with the strength retention of the polybenzazole article untreated with a light-resisting agent (24%; Sample 1), the addition of one or more of the claimed light-resisting agents to polybenzazole articles provides a great improvement in strength retention (%) and, therefore, light resistance.

In contrast, the polybenzazole articles containing Rhodamine B, Acid Fuchin, sodium salt, 1-naphthol, or 2-naphthol as a light-resisting agent (Samples 2-5) had a strength retention of only 23-28%. Comparison of the strength retention (23-28%) with the strength retention of the polybenzazole article not treated with a light-resisting agent (24%; Sample 1) clearly indicates that the addition of the dyes disclosed by So et al. as light-resisting agents to polybenzazole articles did *not* result in significantly higher strength retention (%). In particular, a polybenzazole article containing 1-naphthol actually showed lower strength retention (23%; Sample 4) than did the polybenzazole article not treated with a light-resisting agent (24%; Sample 1). Therefore, the dyes described in So et al. are not particularly useful as light-resisting agents of polybenzazole articles. In direct comparison, the inventive polybenzazole articles unexpectedly had a much higher strength retention than the polybenzazole articles made with the dyes disclosed by So et al. (34-55% vs. 23-28%), *even though the dyes disclosed by So et al. absorb light with a wavelength of 300-600 nm.*

From the foregoing, it is clear that the present invention has surprising and unexpected results (such as dramatically superior strength retention (i.e., light resistance)) not foreseen from the disclosure of So et al. It also is evident that So et al. does not teach the specific light-resisting agents of the pending claims, nor does So et al. teach structural equivalents (as previously admitted by the Office). Thus, So et al. does not provide any

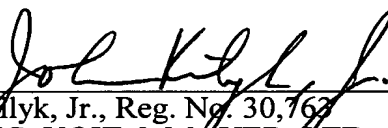
In re Appln. of Kodama et al.
Application No. 09/502,834

teaching or suggestion that explicitly or implicitly would lead one of ordinary skill in the art to arrive at the present invention. In the absence of such a teaching or suggestion, it cannot be properly said that the present invention is obvious in view of So et al. Applicants respectfully request that the obviousness rejection be withdrawn.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In re application of:

Tetsuo KODAMA et al.:

Serial No. 09/502,834:

Filed on February 11, 2000:

Group Art Unit: 1711

Examiner: Duc Truong

For: POLYBENZAZOLE ARTICLE AND PRODUCTION METHOD THEREOF

DECLARATION UNDER 37 CFR 1.132

Honorable Commissioner of
Patents and Trademarks,
Washington, D.C. 20231

Sir:

I, Tetsuo KODAMA, whose full post office address is
c/o Toyo Boseki Kabushiki Kaisha, Research Center, 1-1,
Katata 2-chome, Ohtsu-shi, Shiga 520-0292 Japan, sincerely
declare:

That my education and employment history is as follows:

That I was graduated from Department of Marine Science,
Faculty of Marine Science and Technology, Tokai University
in March 1981,

That I completed the master course study of
Environmental Science at Hiroshima University, graduate
school (Faculty of Integrated Arts and Science) in March
1983,

In April 1983, I was employed by Toyo Boseki Kabushiki
Kaisha, and I have been engaged in the research and
development of base films of magnetic tapes, PPS, RO module,
PBO and so on at Toyo Boseki Analytical Research Center;

That I am one of the inventors of the above-identified
U.S. Patent Application No. 09/502,834 and familiar with the
subject matter of this invention;

That I have reviewed the Office Action dated May 7,
2003 issued in the above-identified application and have
directly conducted the following experiments to show that
the polybenzazole article of the present invention
comprising a light-resisting agent defined in claim 1 is
markedly superior in light resistance as compared to a
polybenzazole article comprising, as a light-resisting
agent, naphthol described in So et al. (USP No. 5,552,221);

That the following Experiments demonstrate such fact,
the results of which follow hereunder;

Experim nts

(1) Object

To prepare the polybenzazole (PBO) article of the present invention comprising a light-resisting agent defined in claim 1 and a polybenzazole article comprising, as a light-resisting agent, naphthol described in So et al. (USP No. 5,552,221) and evaluate the light resistance thereof.

(2) Preparation method of samples for evaluation

(Preparation of PBO sample)

A spinning dope containing polyparaphenylene benzobisoxazole (14.0% by weight) obtained by the method described in USP 4,533,693 and having an intrinsic viscosity as measured with a methanesulfonic acid solution at 30°C, of 24.4 dL/g, and polyphosphoric acid containing phosphorus pentaoxide in 83.17% by weight was spun. The dope was passed through a metal net filter, and kneaded and defoamed in a twin screw kneader. The pressure was elevated, the dope temperature was maintained at 170°C, and the dope was spun at 170°C from a spinneret. The delivered yarns were cooled with cooling air at 60°C and wound around a godet roller to afford a spinning speed. The yarns were led into an extraction (coagulation) bath of a 20% by weight aqueous phosphoric acid solution maintained at a temperature of $20 \pm 2^\circ\text{C}$. The yarns were successively washed with ion exchange water in a second extraction bath, and immersed in a 0.1 mol/L sodium hydroxide solution for neutralization. The resulting undried PBO yarns were preserved in water and used as a sample.

(Preparation of treating solution for light-resisting agent)

Each light-resisting agent shown in the following Table 1 was dissolved in ethanol such that the concentration was 1 g/100 ml and the liquid temperature was about 40°C to give a treating solution. However, since Acid Fuchin, sodium salt has low solubility, the concentration was less than 1 g/100 ml.

(Treatment with light-resisting agent)

The undried PBO yarn (249d, 166f) obtained above was placed in each treating solution while preventing entanglement, and stood at about 40°C for 4 hr. Redundant treating solution was removed by pressing waste (JK wiper paper) and the yarn was dried to give a sample for evaluation.

(3) Evaluation of light resistance

The samples for evaluation (PBO fiber) obtained above were folded three times (for forming a kink band and accelerating the light resistance evaluation) and subjected to xenon light exposure at 83°C for 24 hr. The tensile strength of mainly the part folded 3 times was measured and strength retention was calculated with the tensile strength (DT 40.8 (g/d)) of dry PBO yarn samples free of treatment with a light-resisting agent as 100%.

(4) Evaluation results

The obtained strength retention is shown in the following Table 1.

Table 1

Sample	Light-resisting agent	Strength retention (%) after xenon light exposure for 24 hr
1	Blank (not treated)	24
2	Rhodamine B	26
3	Acid Fuchin, sodium salt	28
4	1-Naphthol	23
5	2-Naphthol	27
6	o-Aminophenol/p-Phenylenediamine=1/1	34
7	m-Phenylenediamine/p-Phenylenediamine=1/1	55

The light-resisting agent (Samples 6 and 7) of the present invention is oxidized in an aqueous solution to form a condensate (colors the aqueous solution black), reacts with or adsorbs to PBO yarn to dye the PBO yarn. By mixing two kinds of light-resisting agents, the


oxidation/condensation proceeds further to afford a striking light resistance effect (higher strength retention (%)).

(5) Conclusion

The polybenzazole articles (Samples 6 and 7) of the present invention comprising a light-resisting agent defined in claim 1 showed significantly higher strength retention (%) (dramatically superior in light resistance) after xenon light exposure for 24 hr, as compared to polybenzazole articles (Samples 2 - 5) comprising, as a light-resisting agent, a dye, particularly naphthol (Samples 4 and 5) described in So et al. (USP No. 5,552,221).

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed at Shiga, Japan on this 29th day of October, 2003


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Tetsuo KODAMA